



**California Department of Fish and Wildlife
Marin County
Lagunitas Creek Watersheds
Stream Habitat Assessment Reports**

Unnamed Tributary # 1 of Lagunitas Creek

Surveyed 2011

Report Completed in 2013

STREAM INVENTORY REPORT

Unnamed Tributary #1 of Lagunitas Creek

INTRODUCTION

A stream inventory was conducted 11/10/2011 to 11/16/2011 on Unnamed Tributary #1 of Lagunitas creek. The survey began at the confluence with Lagunitas Creek and extended upstream 0.6 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Unnamed Tributary #1 of Lagunitas creek.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for Chinook salmon, coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Unnamed Tributary #1 of Lagunitas creek is located in Marin County, California (Map 1). It is a tributary to Lagunitas Creek, which flows into Tomales Bay, which flows into Bodega Bay, which flows into Pacific Ocean. Unnamed Tributary #1 of Lagunitas creek's legal description at the confluence with Lagunitas Creek is T02N R08W Sec.4. Its location is 38.0355 north latitude and 122.7456 west longitude, LLID number 1227456380355. Unnamed Tributary #1 of Lagunitas creek is a first order stream and has approximately 0.9 miles of blue line stream according to the USGS SAN GERONIMO 7.5 minute quadrangle. Unnamed Tributary #1 of Lagunitas creek drains a watershed of approximately 0.4 square miles. Elevations range from about 82 feet at the mouth of the creek to 568 feet in the headwater areas. Evergreen forest dominates the watershed. The watershed is entirely federally owned, which accounts for 100% of the land area. One hundred percent of the land is considered natural. Vehicle access exists via Sir Frances Drake Blvd to the first access road to the Samuel P Taylor Campground. From this point the Cross Marin Trail to the north provides access to the confluence.

METHODS

The habitat inventory conducted in Unnamed Tributary #1 of Lagunitas creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Wildlife (CDFW). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement. All pools, except step-pools, are fully sampled.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Unnamed Tributary #1 of Lagunitas creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others

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(1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Unnamed Tributary #1 of Lagunitas creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Unnamed Tributary #1 of Lagunitas creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Unnamed Tributary #1 of Lagunitas creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Unnamed Tributary #1 of Lagunitas creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-

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described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Unnamed Tributary #1 of Lagunitas creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form.

Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Unnamed Tributary #1 of Lagunitas creek.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. This program processes and summarizes the data, and produces the following ten tables:

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- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Unnamed Tributary #1 of Lagunitas creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of 11/10/2011 to 11/16/2011, was conducted by C. Neill, D. Dela Vega (CCC)/(WSP) . The total length of the stream surveyed was 3,094 feet with an additional 0 feet of side channel.

Stream flow was not measured on Unnamed Tributary #1 of Lagunitas creek creek.

Unnamed Tributary #1 of Lagunitas creek is a A4 channel type for 1,240 feet of the stream surveyed (Reach 1), a G4 channel type for 1,609 feet of the stream surveyed (Reach 2), a NA channel type for 245 feet of the stream surveyed (Reach 3).

A4 channels are steep, narrow, cascading, step-pool streams, high energy debris transporting channels associated with depositional soils, and gravel dominant substrates.

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G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width /depth ratios and gravel dominant substrates. The channel associated with Reach 3 is extremely high gradient with boulder dominant substrate.

Water temperatures taken during the survey period ranged from 46 to 48 degrees Fahrenheit. Air temperatures ranged from 50 to 53 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 40% pool units, 28% riffle units, 27% flatwater units, 3% dry units, 2% culvert units, (Graph 1). Based on total length of Level II habitat types, there were 54% flatwater units, 21% riffle units, 21% pool units, 3% culvert units, 2% dry units, (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 27% mid-channel pool units, 23% step run units, 22% low gradient riffle units) (Graph 3). Based on percent total length, 52% were step run units, 15% low gradient riffle units and 10% step pool units.

A total of 24 pools were identified (Table 3). Main channel pools were the most frequently encountered at 83% (Graph 4), and comprised 83% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. None of the 24 pools had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 24 pool tail-outs measured, 12 had a value of 1 (50%), 10 had a value of 2 (42%), 2 had a value of 5 (8%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 15, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 14 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 14 and scour pools had a mean shelter rating of 15 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Unnamed Tributary #1 of Lagunitas creek. Graph 7 describes the pool cover in Unnamed Tributary #1 of Lagunitas creek. Boulders are the dominant pool cover type, followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the

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dominant substrate observed in pool tail-outs. Gravel substrate was observed in 58% of pool tail-outs and small cobble in 21%.

The mean percent canopy density for the surveyed length of Unnamed Tributary #1 of Lagunitas creek was 93%. Of the canopy present, the mean percentages of hardwood and coniferous trees were 98% and 2%, respectively. Graph 9 describes the mean percent canopy in Unnamed Tributary #1 of Lagunitas creek .

For the stream reach surveyed, the mean percent right bank vegetated was 87%. The mean percent left bank vegetated was 95% (Table 7). The dominant elements composing the structure of the stream banks consisted of 54% cobble/gravel, 21% boulder, 19% sand/silt/clay and 5% bedrock, (Graph 10). Brush was the dominant vegetation type observed in 53% of the units surveyed. Additionally, 41% of the units surveyed had deciduous trees as the dominant vegetation type, and 6% had grass as the dominant vegetation type (Graph 11).

DISCUSSION

Unnamed Tributary #1 of Lagunitas creek is a A4 channel type for 1,240 feet of the stream surveyed, a G4 channel type for 1,609 feet of the stream surveyed, a NA channel type for 245 feet of the stream surveyed. The suitability of A4, G4, and NA channel types for fish habitat improvement structures is/are as follows: A4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors and log cover; G4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover; and NA channel types were not surveyed and suitability cannot be assessed.

The water temperatures recorded on the survey days 11/10/2011 to 11/16/2011, ranged from 46 to 48 degrees Fahrenheit. Air temperatures ranged from 50 to 53 degrees Fahrenheit. This is a suitable water temperature range for salmonids. However, 60° F, if sustained, is near the threshold stress level for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 54% of the total length of this survey, riffles 21%, and pools 21%. The pools are relatively shallow, with 0 of the 24 pools having a maximum residual depth greater than two feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

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Twenty-two of the 24 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. Two of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Unnamed Tributary #1 of Lagunitas creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Nineteen of the 24 pool tail-outs measured had gravel and small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools is 14. The shelter rating in the flatwater habitats is 4. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Unnamed Tributary #1 of Lagunitas creek. Boulders are the dominant cover type in pools, followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 93%. Reach 1 had a canopy density of 92.5%, Reach 2 had a canopy density of 94.2%, Reach 3 had a canopy density of 92.9%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 87% and 95%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

GENERAL RECOMMENDATIONS

Unnamed Tributary # 1 of Lagunitas should be managed as an anadromous, natural production stream.

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encourages not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

RECOMMENDATIONS

- 1) Access for migrating salmonids should be assessed at all road crossings and dams. Sites of particular concern include the Samuel P. Taylor bike access path/ Cross Marin Trail crossing and the associated culvert, which is a fish passage barrier and indentified as a failing culvert in poor condition. All fish passage assessments should be done according to Part 9 of the California Salmonid Stream Habitat Restoration Manual (Flosi et al, 1998). Where needed, crossings should be replaced or modified to improve fish passage.
- 2) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
- 3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from Boulders. Adding high quality complexity with woody cover in the pools is desirable.
- 4) Due to the natural high gradient of the stream, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position	Habitat Unit #	Memo
0	0001.00	Start of survey WP # 032 N38.03553 W122.74535
54	0002.00	Unidentified fish observed
66	0003.00	1+ steelhead observed in/under culvert.
66	0003.00	Culvert #001 is under the Cross Marin Trail, with one associated culvert. Culvert is made of CMP, with height = 7', width = 7', length = 102', diameter = 7', and plunge height = 1'. The maximum depth within 5' is 0.8'. The culvert slope <2% and the culvert is rusted through and smashed. The trail above has collapsed and sink holes are evident. It is likely a barrier to juvenile and adult salmonids. WP# 033 N38.03552 W122.74548
326	0007.00	2 + unidentified fish
845	0018.00	Multiple salmonid young-of-the-year (YOY)

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Position	Habitat Unit #	Memo
		observed
871	0019.00	Landslide on the right bank near the top of the unit is 20 ft x 40 ft
948	0020.00	Landslide along unit
963	0021.00	The gradient is approximately 10-15%. Fifty six feet from the bottom of the habitat unit is a massive boulder blocking channel. It is potentially a fish barrier
1,054	0022.00	Seventy eight feet from the bottom of the unit is massive landslide and slumping on the right bank
1,147	0023.00	Unidentified YOY observed at the top of the habitat unit.
1,240	0024.00	Massive boulder cluster blocks wet channel. Water goes sub-surface, and the gradient of the unit is an estimated 5-8 %
1,428	0032.00	Right bank tributary #1 is unnamed, not flowing, and is mostly dry with isolated pools. Water temperatures downstream = 47 F, upstream = 47 F, and in the tributary = 48 F. The survey crew checked 150' up the tributary and found it is accessible to fish, but no fish were observed. The slope is approximately 10%. The dominant substrate is gravel, and the channel is fairly entrenched. WP # 37 N38.03488 W122.74940
1,575	0037.00	Aquatic vegetation is Equisetum Spp. (Horsetail)
1,774	0041.00	Left bank tributary #2 is unnamed, and is dry. Water temperatures downstream = 48 F, upstream = 48 F, and in the tributary = N/A. The survey crew checked 300' up the tributary and found it is accessible to fish, but no fish were observed. The tributary has an estimated slope = 2-5%. The dominant substrate is gravel and cobble, and the channel is entrenched. WP # 039 N38.03471 W122.75061
2,128	0047.00	Old irrigation pipe in stream near tributary
2,128	0047.00	Right bank tributary #3 is unnamed and is dry. Water temperatures are unknown. The survey crew checked 120' up the tributary and found it is not accessible to fish and no fish were observed. The slope is unknown. The dominant substrate is sand and small gravel. The tributary is poorly entrenched, and probably contributes little to no water in high flows. At the confluence is a 4-5 ft plunge to creek. WP # 40

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Position	Habitat Unit #	Memo
		N38.03363 W122.122.75182
2,425	0051.00	Right bank tributary # 4 is unnamed and is flowing, with an estimated discharge = 0.05-0.1 cfs and contributing approximately 2-6% of flow to the receiving stream. Water temperatures downstream = 46 F, upstream = 47 F, and in the tributary = 47 F. The survey crew checked 175' up the tributary and found it is accessible to fish, but no fish were observed. The tributary has an estimated slope = 2-4%. The tributary entrenchment makes the channel look boxy. The first 175 ft is low gradient then becomes high gradient with boulders and associated plunges. WP # 042 N38.03357 W122.75213
2,553	0053.00	63 ft in unit is fence up left bank 75 ft from creek, approx 50 ft long
2,849	0054.00	Pool created by landslide slump on left bank
2,865	0055.00	Landslide/ slump on left bank 30' x 15'. The right bank has been cut by water exposing wall, highly erodible
2,891	0056.00	Right bank cut by water exposing wall, highly erodible
2,906	0057.00	Right bank cut by water exposing wall, highly erodible
2,925	0058.00	Right bank cut by water exposing wall, highly erodible
2,925	0058.00	The gradient > 15%
3,014	0059.00	Plunge by boulders is approximately 8 ft tall
3,027	0060.00	Gradient > 15%. There is a continual slump/ landslide on both banks of creek, WP # 043 N
3,094	0060.00	End of Survey due to consecutive barriers occurring between units 56-60. The channel changes at habitat unit 54 and becomes very high gradient. Calculated slope= 20.3% for units 56-60 WP # 043 38.03314 W 122.75398

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

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McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.

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LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

CASCADE

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

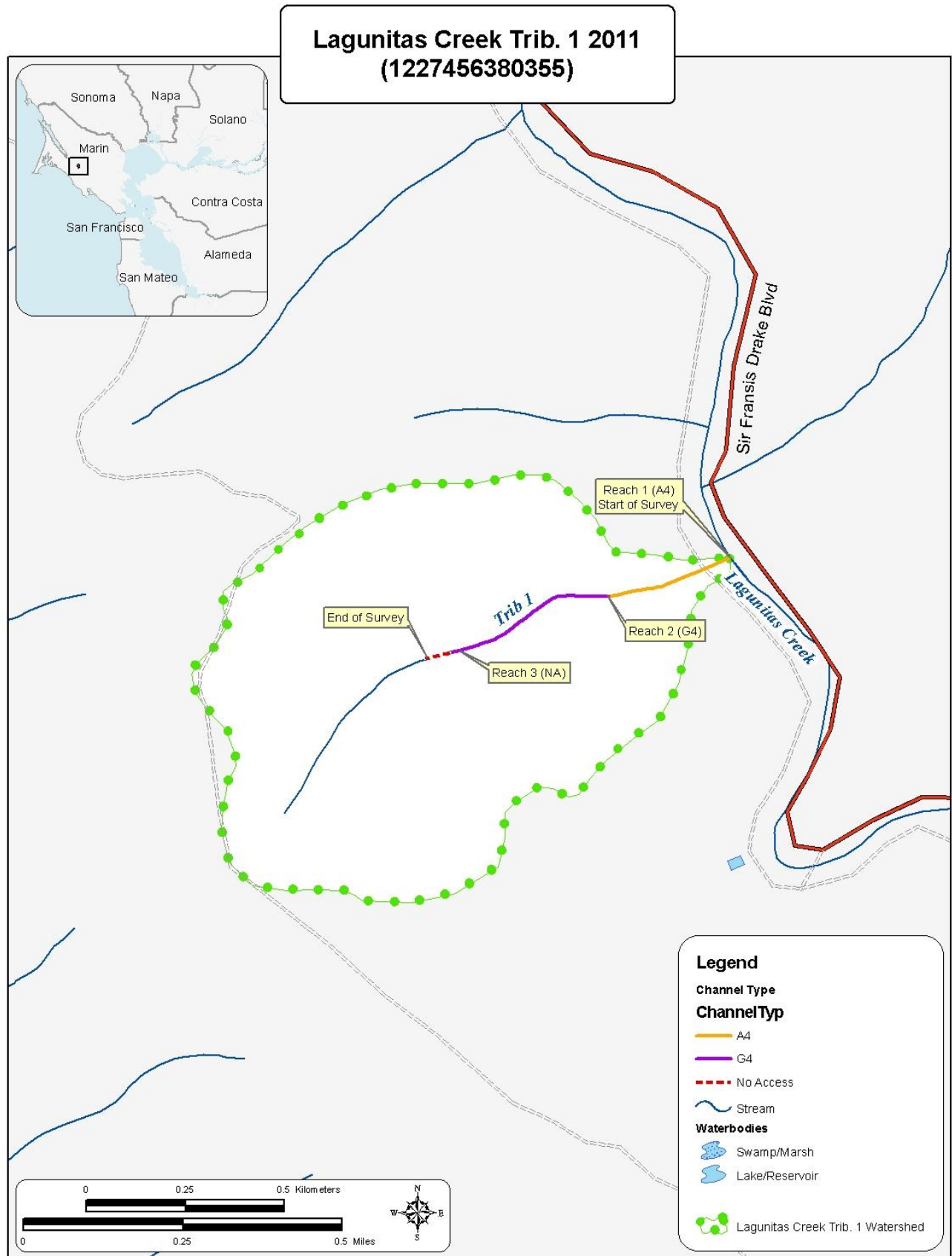
BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to marsh	(MAR)	[9.1]	

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Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: 1227456380355

LLID: 1227456380355

Drainage: Tomales Bay

Survey 11/10/2011 to 11/16/2011

Confluence Location: Quad: INVERNESS

Legal Description: T000R000S00

Latitude: 38:02:08.0N

Longitude: 122:44:44.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
1	0	CULVERT	1.7	102	102	3.3									
2	0	DRY	3.3	24	48	1.6									
16	16	FLATWATER	26.7	104	1659	53.6	3.9	0.2	0.6	70	1116	15	237		4
24	24	POOL	40.0	27	637	20.6	4.8	0.4	1.0	61	1456	34	820	28	14
17	17	RIFFLE	28.3	38	648	20.9	1.8	0.1	0.4	15	254	2	33		15
Total Units	Total Units Fully Measured				Total Length (ft.)						Total Area (sq.ft.)		Total Volume (cu.ft.)		
60	57				3094						2825		1091		

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Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: 1227456380355

LLID: 1227456380355

Drainage: Tomales Bay

Survey 11/10/2011 to 11/16/2011

Confluence Location: Quad: INVERNESS

Legal Description: T000R000S00

Latitude: 38:02:08.0N

Longitude: 122:44:44.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
13	13	LGR	21.7	36	464	15.0	2.0	0.1	0.5	18	237	2	31		18	90
2	2	HGR	3.3	78	156	5.0	2.0	0.2	1.3	7	15	1	2		8	98
2	2	CAS	3.3	14	28	0.9	1.0	0.1	0.3	1	2	0	0		0	96
2	2	RUN	3.3	30	59	1.9	6.0	0.4	0.8	40	81	15	30		3	96
14	14	SRN	23.3	114	1600	51.7	4.0	0.2	0.9	74	1035	15	207		4	94
16	16	MCP	26.7	14	224	7.2	5.0	0.5	1.6	58	922	35	565	29	12	94
4	4	STP	6.7	76	303	9.8	4.0	0.3	1.5	96	384	41	162	29	24	95
4	4	CRP	6.7	28	110	3.6	5.0	0.5	1.1	37	149	23	94	20	15	93
2	0	DRY	3.3	24	48	1.6										96
1	0	CUL	1.7	102	102	3.3										
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume				
60	57				3094					2825		1091(cu.ft.)				

Unnamed trib 1 to Lagunitas creek

Table 3 - Summary of Pool Habitat Types

Stream Name: 1227456380355

LLID: 1227456380355

Drainage: Tomales Bay

Survey 11/10/2011 to 11/16/2011

Confluence Location: Quad: INVERNESS

Legal Description: T000R000S00

Latitude: 38:02:08.0N

Longitude: 122:44:44.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid. Vol (cu.ft.)	Mean Shelter Rating
20	20	MAIN	83	26	527	83	4.8	0.4	65	1307	29	582	14
4	4	SCOUR	17	28	110	17	4.8	0.5	37	149	20	79	15
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
24	24				637					1456		661	

Table 4 - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: 1227456380355			LLID: 1227456380355					Drainage: Tomales Bay					
Survey 11/10/2011 to 11/16/2011			Confluence Location: Quad: INVERNESS					Legal Description: T000R000S00		Latitude: 38:02:08.0N		Longitude: 122:44:44.0W	
Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence	
16	MCP	67	8	50	8	50	0	0	0	0	0	0	
4	STP	17	1	25	3	75	0	0	0	0	0	0	
4	CRP	17	2	50	2	50	0	0	0	0	0	0	
Total Units			Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Feet Max Resid. Depth	Total 1< 2 Feet % Occurrence	Total 2< 3 Feet Max Resid. Depth	Total 2< 3 Feet % Occurrence	Total 3< 4 Feet Max Resid. Depth	Total 3< 4 Feet % Occurrence	Total >= 4 Feet Max Resid. Depth	Total >= 4 Feet % Occurrence	
24			11	46	13	54	0	0	0	0	0	0	
Mean Maximum Residual Pool Depth (ft.): 1													

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Table 5 - Summary of Mean Percent Cover By Habitat

Stream Name:		1227456380355		Dry Units:		2		LLID:		1227456380355		Drainage:		Tomales Bay	
Survey		11/10/2011 to 11/16/2011		Legal Description:		T000R000S00		Latitude:		38:02:08.0N		Longitude:		122:44:44.0W	
Confluence Location:		Quad: INVERNESS		Mean % SWD		Mean % LWD		Mean % Root Mass		Mean % Terr. Vegetation		Mean % Aquatic Vegetation		Mean % White Water	
Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges				
13	13	LGR	18	7	2	0	12	8	0	8	0				
2	2	HGR	25	0	0	0	0	0	0	75	0				
2	2	CAS	0	0	0	0	0	0	0	0	0				
17	17	TOTAL RIFFLE	17	5	1	0	9	6	0	15	0				
2	2	RUN	0	0	0	0	0	0	0	50	0				
14	14	SRN	1	15	10	0	5	4	0	6	2				
16	16	TOTAL FLAT	1	13	9	0	4	3	0	12	2				
16	16	MCP	8	9	8	3	5	0	0	30	6				
4	4	STP	0	5	18	9	11	0	0	58	0				
4	4	CRP	13	15	0	28	13	0	0	33	0				
24	24	TOTAL POOL	8	9	8	8	7	0	0	35	4				
1	0	CUL													
60	57	TOTAL	8	9	6	3	7	3	0	22	2				

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: 1227456380355 **Dry Units:** 2 **LLID:** 1227456380355 **Drainage:** Tomales Bay

Survey 11/10/2011 to 11/16/2011

Confluence Location: **Quad:** INVERNESS **Legal Description:** T000R000S00 **Latitude:** 38:02:08.0N **Longitude:** 122:44:44.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
13	13	LGR	0	15	77	8	0	0	0
2	2	HGR	0	0	0	0	0	100	0
2	2	CAS	0	0	0	0	0	100	0
2	2	RUN	50	0	0	50	0	0	0
14	14	SRN	0	0	64	36	0	0	0
16	16	MCP	13	25	56	6	0	0	0
4	4	STP	0	0	25	75	0	0	0
4	4	CRP	50	25	0	25	0	0	0
1	0	CUL	0	0	0	0	0	0	0

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Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: 1227456380355 **LLID:** 1227456380355 **Drainage:** Tomales Bay
Survey 11/10/2011 to 11/16/2011
Confluence Location: Quad: INVERNESS **Legal Description:** T000R000S00 **Latitude:** 38:02:08.0N **Longitude:** 122:44:44.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
93	2	98	0	87	95

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Unnamed trib 1 to Lagunitas creek

Table 8 - Fish Habitat Inventory Data Summary

Stream 1227456380355 LLID: 1227456380355 Drainage Tomales Bay
 Survey Dates: 11/10/2011 to 11/16/2011 Survey Length (ft.): 3094 Main Channel (ft.): 3094 Side Channel (ft.): 0
 Confluence Location: Quad INVERNESS Legal Description: T000R000S00 Latitude: 38:02:08.0N Longitude: 122:44:44.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: A4	Canopy Density (%): 92.5	Pools by Stream Length	34.5
Reach Length (ft.): 1240	Coniferous Component (%): 1.8	Pool Frequency (%):	39.1
Riffle/Flatwater Mean Width (ft.): 3.9	Hardwood Component	Residual Pool Depth (%):	
BFW:	Dominant Bank	< 2 Feet Deep:	100.0
Range (ft.): 11.00 to 13.00	Vegetative Cover (%): 96.1	2 to 2.9 Feet Deep:	0.0
Mean (ft.): 11.87	Dominant	3 to 3.9 Feet Deep:	0.0
Std. Dev.: 0.99	Dominant Bank Substrate	>= 4 Feet Deep:	0.0
Base Flow (cfs): 0	Occurrence of LWD (%): 8.6	Mean Max Residual Pool Depth	0.98
Water (F): 46 - 48	Air (F): 50 - 52	LWD per 100 ft.:	Mean Pool Shelter
Dry Channel (ft.): 15		Riffles: 1	
		Pools: 2	
		Flat: 2	

Pool Tail Substrate (%): Silt/Clay: 11.1 Sand: 22.2 Gravel: 11.1 Sm Cobble: 44.4 Lg Cobble: 11.1 Boulder 0.0 Bedrock: 0.0
 Embeddedness Values (%): 1. 22.2 2. 66.7 3. 0.0 4. 0.0 5. 11.1

STREAM REACH: 2

Channel Type: G4	Canopy Density (%): 94.2	Pools by Stream Length	12.0
Reach Length (ft.): 1609	Coniferous Component (%): 2.2	Pool Frequency (%):	46.7
Riffle/Flatwater Mean Width (ft.): 2.2	Hardwood Component	Residual Pool Depth (%):	
BFW:	Dominant Bank	< 2 Feet Deep:	100.0
Range (ft.): 7.00 to 11.00	Vegetative Cover (%): 94.8	2 to 2.9 Feet Deep:	0.0
Mean (ft.): 8.67	Dominant	3 to 3.9 Feet Deep:	0.0
Std. Dev.: 1.70	Dominant Bank Substrate	>= 4 Feet Deep:	0.0
Base Flow (cfs): 0	Occurrence of LWD (%): 6.2	Mean Max Residual Pool Depth	1.01
Water (F): 47 - 48	Air (F): 50 - 53	LWD per 100 ft.:	Mean Pool Shelter
Dry Channel (ft.): 33		Riffles: 2	
		Pools: 3	
		Flat: 1	

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 85.7 Sm Cobble: 7.1 Lg Cobble: 7.1 Boulder 0.0 Bedrock: 0.0
 Embeddedness Values (%): 1. 71.4 2. 21.4 3. 0.0 4. 0.0 5. 7.1

Unnamed trib 1 to Lagunitas creek

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: NA	Canopy Density (%): 92.9	Pools by Stream Length: 6.5
Reach Length (ft.): 245	Coniferous Component (%): 0.0	Pool Frequency (%): 14.3
Riffle/Flatwater Mean Width (ft.): 2.0	Hardwood Component: 100.0	Residual Pool Depth (%):
BFW:	Dominant Bank: Brush	< 2 Feet Deep: 100.0
Range (ft.): 11.00 to 11.00	Vegetative Cover (%): 57.9	2 to 2.9 Feet Deep: 0.0
Mean (ft.): 11.00	Dominant: Boulders	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 0.00	Dominant Bank Substrate: Boulder	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0	Occurrence of LWD (%): 0.0	Mean Max Residual Pool Depth: 0.6
Water (F): 48 - 48	Air (F): 51 - 51	LWD per 100 ft.:
Dry Channel (ft.): 0	Riffles: 2	Pools: 0
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 0.0	Sand: 0.0	Gravel: 100.0
Embeddedness Values (%):	1. 0.0	2. 100.0
	3. 0.0	4. 0.0
	5.	
	Sm Cobble: 0.0	Lg Cobble: 0.0
	Boulder: 0.0	Bedrock: 0.0

Table 9 -Mean Percentage of Dominant Substrate and Vegetation

Stream Name: 1227456380355 **LLID:** 1227456380355 **Drainage:** Tomales Bay
Survey 11/10/2011 to 11/16/2011
Confluence Location: Quad: INVERNESS **Legal Description:** T000R000S00 **Latitude:** 38:02:08.0N **Longitude:** 122:44:44.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	4	2	5.1
Boulder	14	11	21.2
Cobble/Gravel	28	36	54.2
Sand/Silt/Clay	13	10	19.5

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage
Grass	3	4	5.9
Brush	35	27	52.5
Hardwood	20	28	40.7
Coniferous	0	0	0.0
No Vegetation	1	0	0.8

Total Stream Cobble Embeddedness Values: 2

Unnamed trib 1 to Lagunitas creek

Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

Stream Name: 1227456380355

LLID: 1227456380355

Drainage: Tomales Bay

Survey 11/10/2011 to 11/16/2011

Confluence Location: Quad: INVERNESS

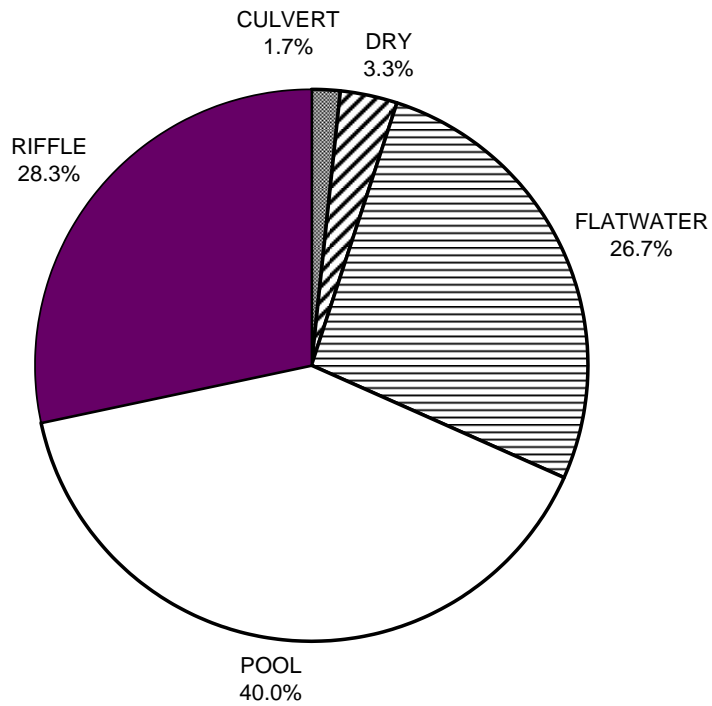
Legal Description: T000R000S00

Latitude: 38:02:08.0N

Longitude: 122:44:44.0W

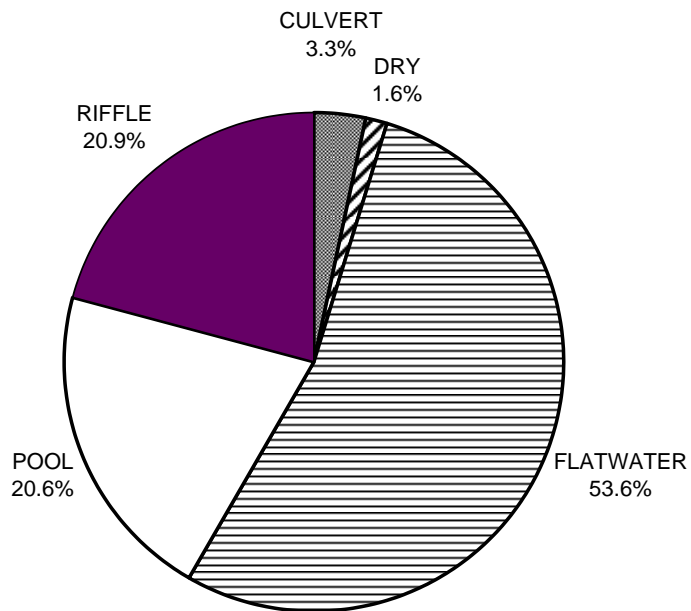
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	17	1	8
SMALL WOODY DEBRIS (%)	5	13	9
LARGE WOODY DEBRIS (%)	1	9	8
ROOT MASS (%)	0	0	8
TERRESTRIAL VEGETATION	9	4	7
AQUATIC VEGETATION (%)	6	3	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	15	12	35
BEDROCK LEDGES (%)	0	2	4

**1227456380355 2011
HABITAT TYPES BY PERCENT OCCURRENCE**



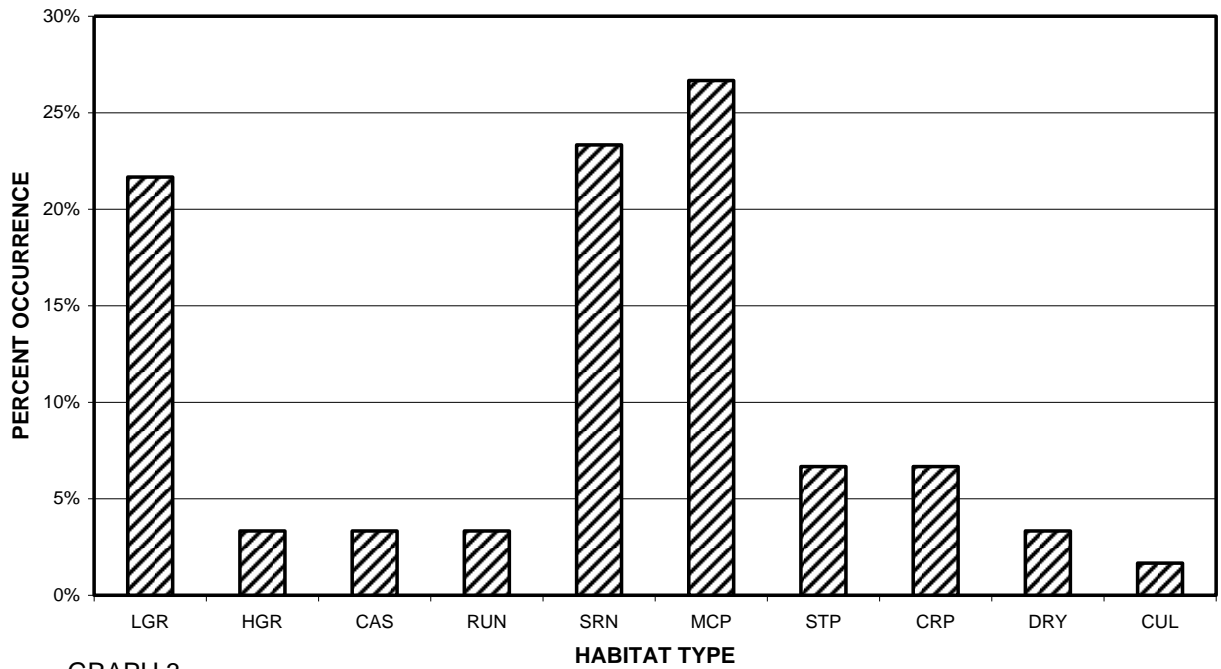
GRAPH 1

**1227456380355 2011
HABITAT TYPES BY PERCENT TOTAL LENGTH**



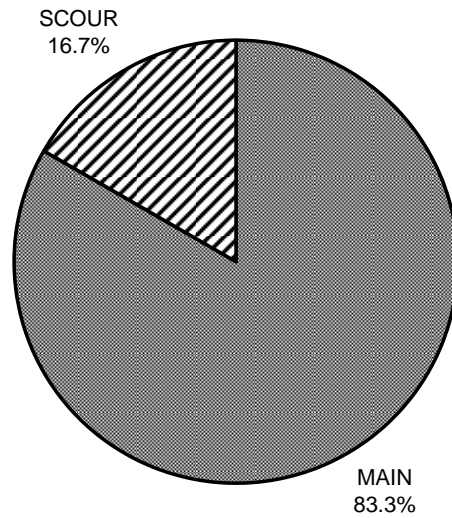
GRAPH 2

**1227456380355 2011
HABITAT TYPES BY PERCENT OCCURRENCE**



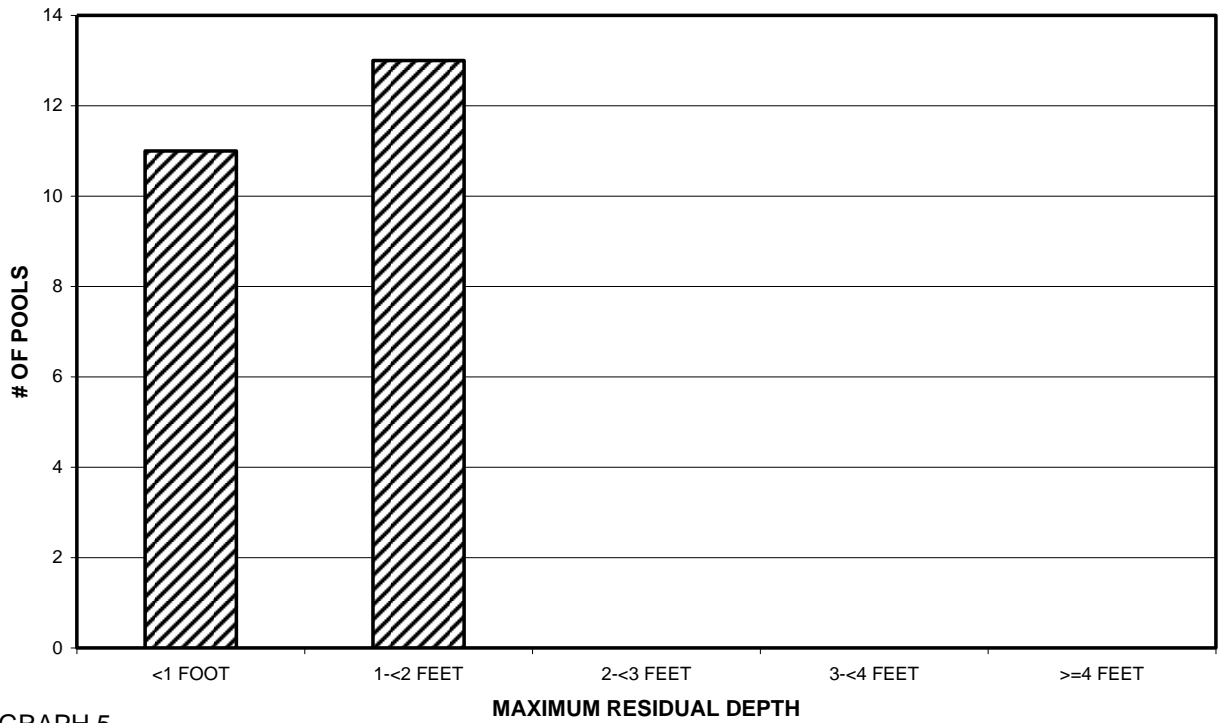
GRAPH 3

**1227456380355 2011
POOL TYPES BY PERCENT OCCURRENCE**



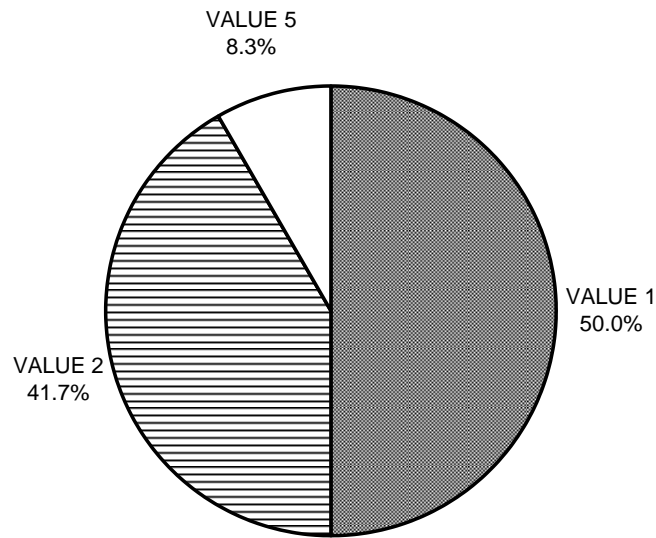
GRAPH 4

**1227456380355 2011
MAXIMUM DEPTH IN POOLS**



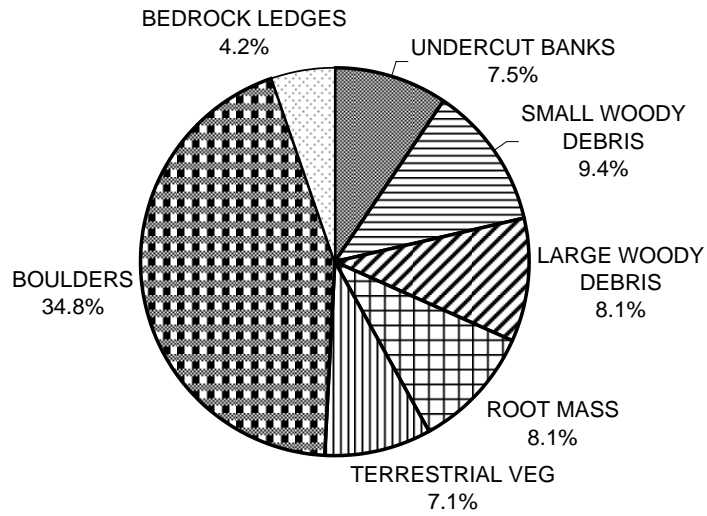
GRAPH 5

**1227456380355 2011
PERCENT EMBEDDEDNESS**



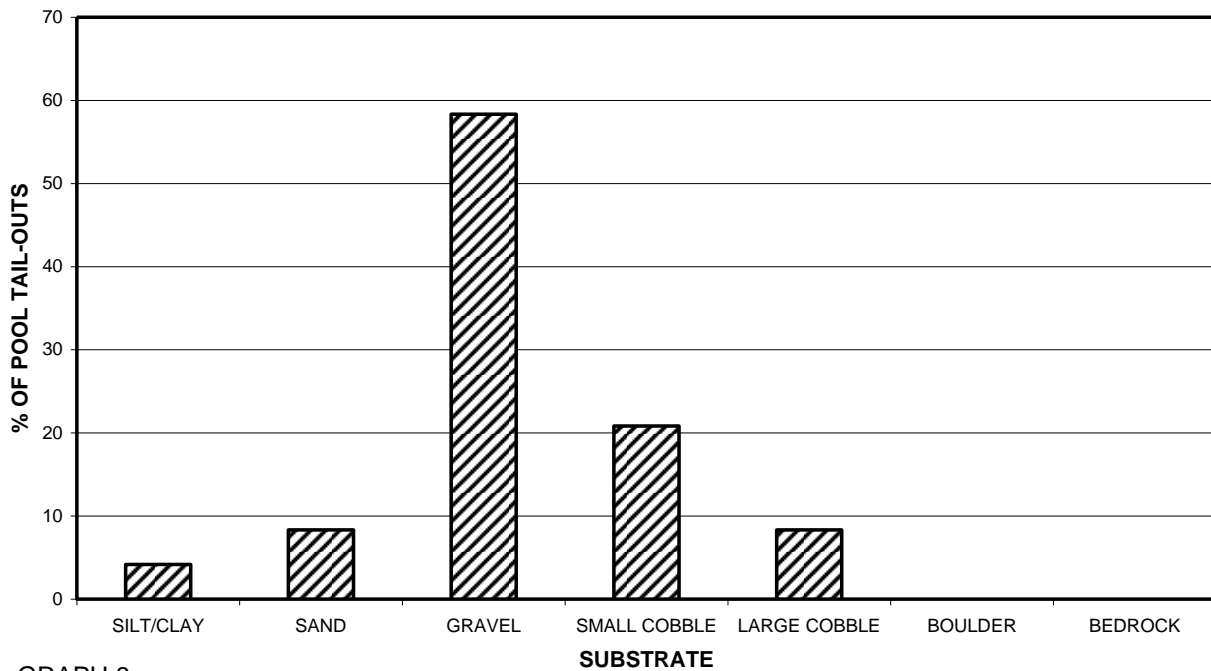
GRAPH 6

1227456380355 2011
MEAN PERCENT COVER TYPES IN POOLS



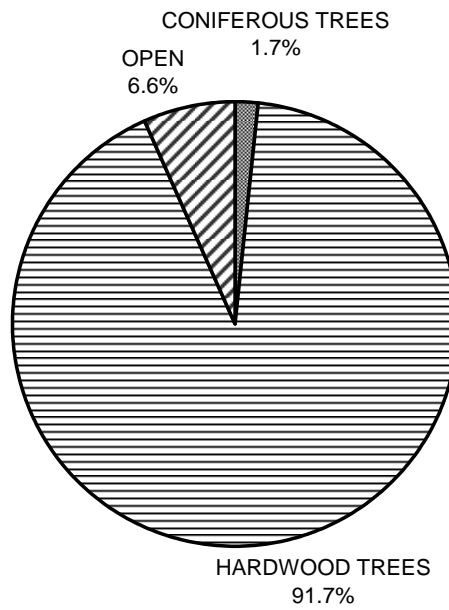
GRAPH 7

1227456380355 2011
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



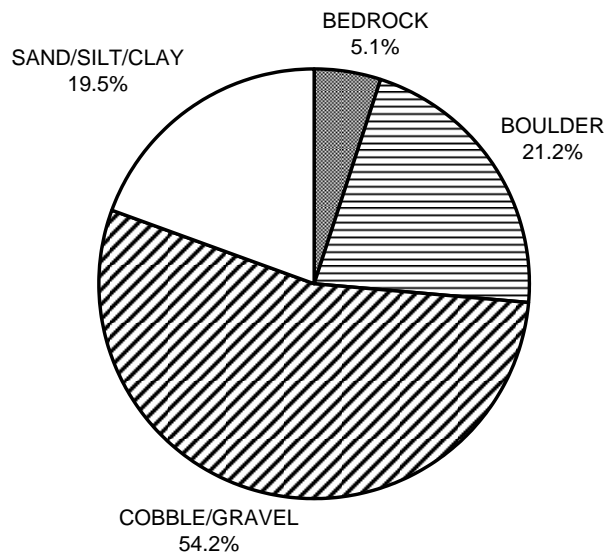
GRAPH 8

**1227456380355 2011
MEAN PERCENT CANOPY**



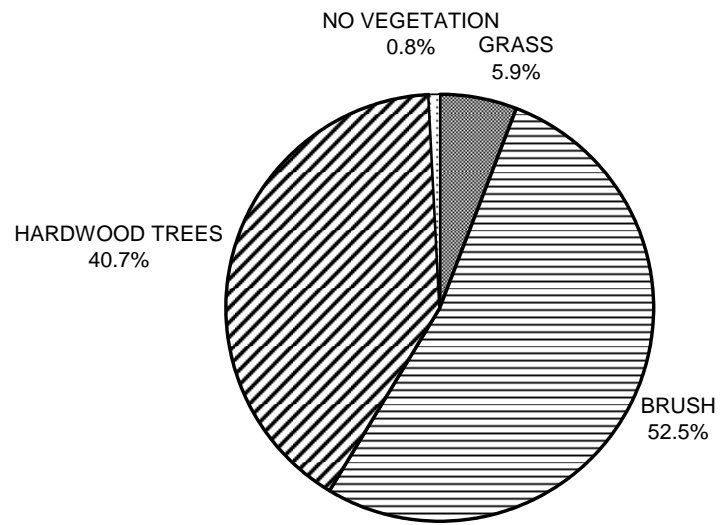
GRAPH 9

**1227456380355 2011
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

1227456380355 2011
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Unnamed trib 1 to Lagunitas creek